

Original Research Article

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Effect of pre and post emergence herbicide for weed management in onion bulb yield in northern dry zone of Karnataka, India

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ABSTRACT

A field experiment was conducted at College of Horticulture, Munirabad, Koppal district of Karnataka which falls under Northern Dry Zone of Karnataka, India for two consecutive *kharif* seasons 2014 and 2015 to find out most suitable and efficient combination of different pre-plant and post-emergence herbicides to control weeds in onion. Experiment was conducted in randomized block design with 12 treatments and three replications consisting of oxyfluorfen were used as pre emergence while oxyfluorfen and fenoxaprop-p-ethyl were used as post emergence and their different combinations. The pre-plant application of oxyfluorfen 23.5 EC@ 240 g a.i/ha followed by post-emergence application of Fenoxaprop – p- ethyl 9 EC@ 270 a.i./ha mixed with oxyfluorfen 23.5 EC resulted in effective control of various broad-leaf and grassy-weeds and recorded lower in total weed density and dry weight of weeds. The same treatments recorded maximum Neck thickness, diameter of the bulb, weight of bulb and Bulb yield (275.8 qt/ha and 271.9 qt/ha) respectively during both the year due to higher weed control efficiency (88.6 and 89.9 %) over all the other chemical weed control treatments.

Keywords

Oxyfluorfen,
Fenoxaprop-p-ethyl,
Onion Bulb yield
and weed control
efficiency

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Introduction

Onion (*Allium cepa* L.) is the most important commercial vegetable and spice crop grown in India. It is popularly known as “Queen of kitchen” due to its various benefits. In India, it

is grown over an area of 1.09 million hectares with an annual production of 17.51 million tons and productivity of 14.35 t ha⁻¹ (Anon., 2016). India ranks second in the world after China by contributing 12.30 per cent to the world onion production. Karnataka is one of

the leading states in onion cultivation next to Maharashtra and Gujarat. In Karnataka, occupying an area of 1.65 lakh hectares with a production of 30.31 lakh tonnes with an average productivity of 18.40 t ha⁻¹ (Anon., 2016). Weed infestation is one of the limiting factors in crop production. Weeds compete with plants for nutrients, soil moisture, sunlight and space. Reduction in crop yield has direct correlation with weed competition. Proper control of weeds is essential in obtaining optimum plant growth, higher yield and quality of onion. In onion, the management of weed is one of the most serious problems due to narrow spacing which limits the crop yield and decrease profits. Proper control of weeds is essential in obtaining optimum plant growth, higher yield and quality of onion. Crop weed competition has long been recognized as one of the major constraints in onion cultivation. Weeds cause reduction in onion bulb yield up to 40 to 80 per cent (Channapagoudar and Biradar 2007 and Kantesh Gandolkar, 2014). Due to its slow growth and lack of adequate foliage and shallow root system makes onion crop weak competitor against weeds. In addition, their cylindrical upright leaves do not shade the soil to smother weed growth as result of very poor leaf area index. Due to closer planting and shallow root system of onion, manual weeding is tedious, expensive and time consuming.

The conventional methods of weed control such as hoeing, weeding, etc. are laborious and very expensive. More over weeding during critical growth stages is very difficult due to increased cost of human labors and its scarce availability. Use of pre-plant and post-emergence herbicides may prove as the solution for over dependence on labors in onion weed control, but their proper combination, doses and time of application is more important for better results with low cost. Hence, present investigation was

conducted to find out best suitable combination of pre-plant and post-emergence herbicides in for effective control of weeds with higher bulb yield of onion.

Materials and Methods

An Field experiment were conducted during the *Kharif* 2014 and 2015 at College of Horticulture, Munirabad, Koppal district which comes under Northern Dry Zone of Hyderabad- Karnataka region, India. It is situated between 15° 09' 00" to 16° 03' 30" North Latitude and 75° 47' 30" to 76° 48' 10" East Longitude and altitude of 529mtr MSL. The soil of the experimental site was red sandy loam in texture with pH 6.5-7.5 having low CEC (7.50 C mol kg⁻¹) with an EC of 0.25 dSm⁻¹, organic carbon content was 0.47 per cent and soil was lower, higher and medium available NPK respectively. The average annual rainfall was 564 mm distributed in 37 rainy days (> 2.5 mm). An amount of 494 mm and 486 mm of rainfall was received during cropping period in 2014 and 2015 respectively.

To study the "Effect of herbicides for weed management in onion bulb yield. The experiment was laid out in RCBD with three replications. The 12 treatments comprised of different weed management treatments they are Herbicides *viz.*, oxyfluorfen were used as pre emergence while oxyfluorfen and fenoxaprop-p-ethyl were used as post emergence and compared with other treatments.

Onion variety arkakalyana were selected for the study. Regular biometric observations were recorded at specific time intervals by selecting randomly five plants in each treatment. Weed density (no./m²) and biomass of weeds (g/m²) were recorded by putting a quadrat of 0.5 m² at two random spots in each plot. Weed control efficiency

was calculated by standard formula. The weather conditions were favorable for raising crops and two protective irrigations were provided during dry spells and crops were free from pest and diseases by timely prophylactic measures. The experimental data were analysed statistically by following Fischer's method of analysis of variance wherever 'F' test was significant at $P=0.05$. The results have been compared among treatments based on critical difference at same level of significance.

Results and Discussion

Effects on weeds

The pre dominant weed species in the experimental plot were *cynodon dactylon*, *Cyperus rotundus*, *Parthenium hysterophorous*, *Amranthus viridis*, and *Chenopodium album*, *Euphorbia spp* etc. All treatments caused significant reduction in total weed density and dry weight of weeds as compared to control (Table 3). Significantly lower weed density (2.3 and 2.4 no. /0.5m²), weed dry weight (2.6 and 2.6 g/ 0.5m²) was observed in application of oxyfluorfin 23.5 EC@ 240 g a.i./ha + Fenoxaprop – p- ethyl 9 EC@ 270 a.i./ha (two times at 25 and 45 DAT) onion respectively during both the year. However, it was on par with treatment oxyfluorfin 23.5 EC@240 g a.i./ha + two hand weeding at 20 and 40 DAT. Highest weed density and dry weight recorded in control (weedy check) over rest of the treatments. The above treatments recorded lower weed density and dry weight is due to higher weed control efficiency (88.6and 89.9 %) respectively during both the year. All the weed control treatments recorded significantly lower total weed population than unweeded check at different stages of crop growth. Application of herbicides might have prevented not only the germination of susceptible weed seeds but also arrested the

cell division and protein synthesis of nearly emerged weeds in the later stages of crop. Higher total weed population was observed in unweeded check because weeds were allowed to grow throughout the crop season. Application of herbicides might have prevented not only the germination of susceptible weed seeds but also arrested the cell division and protein synthesis of nearly emerged weeds in the later stages of crop similar effects reported by Bhalla (1978) and Tiwari et al. (2003). Lower density of grassy and broad-leaved weeds, weed biomass and weed index and higher weed control efficiency as compared to all the other herbicidal treatments. This might be due to the combined action of pre-planting and post-emergence herbicides used in onion. Significantly lower dry weight of weeds was retained when the herbicides were used either pre emergence with one hand weeding or in sequence with post emergence and were on par among themselves. The higher WCI in these treatments could be attributed by effective control of weeds by oxyfluorfen as pre and post emergence application and herbicide remain persist in the soil for longer period. Similar results are observed in the study carried out by Channapagoudar and Biradar 2007 and Kantesh Gandolkar,2014 at Dharwad and Sable (2011) in transplanted onion.

Effect on crop Growth: All the weed management treatment was significantly superior over control in respect of all growth and yield attributes. Significantly higher plant height (59.5cm and 58.4cm), number of leaves per plant (13.50 and 13.0), Neck thickness (1.35 mm and 1.33mm), diameter of the bulb (41.9 mm and 41.4mm), weight of bulb |(122.5g and119.3g) and Bulb yield (275.8 qt/ha and 271.9 qt/ha) respectively during both the year was recorded in application of Oxyfluorfin 23.5 EC @ 240 g.a. i/ha + Fenoxaprop – p-ethyl 9 EC @ 270g

ai/ha (Two times at 25 and 45 DAT) Table 1. g.a.i/ha+Two hand weeding at 20 and 40
to 4) followed by Oxyflurofin 23.5 EC @ 240 DAT over rest of the treatments.

Table.1 Effect of weed management practices on Plant height (cm), Leaves per plant and Neck thickness (mm) in Onion

Treatment	Plant height (cm)		Leaves per plant		Neck thickness (mm)	
	2014	2015	2014	2015	2014	2015
T1	47.4	43.3	9.4	7.5	1.18	1.10
T2	43.3	42.7	8.3	8.0	1.14	1.12
T3	44.4	43.8	9.0	8.5	1.16	1.14
T4	50	49.1	10.5	10.3	1.22	1.20
T5	56.5	55.4	12.8	12.3	1.28	1.24
T6	58	57.2	13.0	12.5	1.30	1.27
T7	59.5	58.4	13.5	13.0	1.35	1.33
T8	58.6	57.6	13.2	12.5	1.32	1.30
T9	56	55	12.4	12.0	1.26	1.24
T10	58.8	57.9	13.3	12.7	1.34	1.31
T11	53.2	52.8	11.3	11.0	1.24	1.22
T12	25.3	24.9	7.1	7.0	0.90	0.80
S.Em±	1.88	1.56	0.5	0.3	0.10	0.10
C.D @5%	5.61	4.66	1.3	1.0	NS	NS

Table.2 Effect of weed management practices on yield attributes and Bulb yield (q/ha) of Onion

Treatment	Diameter of bulb (mm)		Weight of bulb (g)		Bulb yield (q/ha)	
	2014	2015	2014	2015	2014	2015
T1	31.3	30.5	103.2	93.1	193.2	184.5
T2	29.8	29.5	96.8	94.3	187.8	184.9
T3	30.1	29.8	100.0	98.5	189.9	186.3
T4	35.5	35.2	104.7	101.3	209.0	205.6
T5	41.0	39.9	115.5	112.4	221.1	215.3
T6	40.9	40.1	116.3	113.0	258.7	252.3
T7	41.9	41.4	122.5	119.3	275.8	271.9
T8	38.8	38.2	118.8	115.8	267.1	262.4
T9	38.0	37.7	108.9	106.3	250.6	247.3
T10	39.0	38.6	119.3	116.2	270.2	266.7
T11	35.7	35.5	102.2	100.1	233.9	222.9
T12	22.3	22.0	60.7	55.2	95.0	88.6
S.Em±	1.40	1.10	4.12	3.86	9.24	8.83
C.D @5%	4.10	3.30	12.34	11.6	27.65	26.50

Table.3 Effect of weed management practices on Weed density (no./0.5m²), Weed dry weight (g/0.5 m²) and Weed control efficiency (%) at 35 DAT in onion

Treatment	Weed density (no./0.5m ²)		Weed dry weight (g/0.5m ²)		Weed control efficiency (%)	
	2014	2015	2014	2015	2014	2015
T1	3.7(14.0)	3.9(15.0)	3.9(15.1)	4.0(16.2)	75.3	76.2
T2	4.0(16.0)	4.2(17.3)	4.1(17.0)	4.3(18.3)	72.2	73.1
T3	3.9(15.3)	4.0(16.0)	4.0(16.2)	4.2(17.4)	73.5	74.4
T4	3.5(12.0)	3.5(12.3)	3.8(14.1)	3.9(14.9)	77	78.1
T5	2.9(8.3)	3.0(9.0)	3.0(9.0)	3.1(9.5)	85.3	86
T6	2.8(8.0)	2.9(8.3)	3.0(9.1)	2.9(8.6)	85.1	87.4
T7	2.3(5.3)	2.4(6.0)	2.6(7.0)	2.6(6.9)	88.6	89.9
T8	2.5(6.5)	2.7(7.2)	2.9(8.2)	2.9(8.5)	86.6	87.5
T9	2.9(8.3)	3.0(9.0)	3.1(9.9)	3.2(10.1)	83.8	85.2
T10	2.5(6.3)	2.6(7.0)	2.8(8.0)	2.9(8.2)	86.9	88
T11	3.0(9.0)	3.0(9.3)	3.3(10.6)	3.3(11.0)	82.2	83.8
T12	5.9(35.0)	6.5(42.0)	7.8(61.2)	8.3(68.1)	-	-
S.Em±	0.06	0.07	0.07	0.08	0.28	0.29
C.D @5%	0.18	0.2	0.2	0.24	0.83	0.88

The primary mode of action of Oxyfluorfen inhibits the enzyme protoporphyrinogen oxidase, PPO or Protox, a step in porphyrin pathway that produces half of the chlorophyll molecule. In light, protox inhibitors cause accumulation of large amounts of the phytotoxic molecule protoporphyrin or proto. Proto accumulation quickly damages lipids and proteins resulting in chlorophyll and carotenoid pigment loss and leaky membranes that lead to cell desiccation and disintegration. Fenoxaprop-p-ethyl is a selective herbicide with contact and systemic action and used to control annual and perennial grassy weeds. It is absorbed principally by leaves, with translocation both acropetally and besipetally to the roots or rhizome. This may be due to use of pre emergence herbicide in initial stages resulted in extended weed free period and better crop. The crop growth parameters were increased in this herbicidal treatment which controlled the weeds effectively. Such findings were also reported by Same results

are in conformity with findings of Channappagoudar and Biradar (2007), Kantesh Gandolkar, 2014). Sable *et al.* (2013). This was in conformity with the results of, Atre (2001). it could be attributed by effective control of weeds and herbicide persists in the soil for longer period of time. The higher WCE in these treatments could be attributed by effective control of weeds by oxyfluorfen as pre and post emergence application and herbicide remain persist in the soil for longer period. Similar reports have been made by Sable (2011) and vashi *et al.*(2011).This indicated the effectiveness of weedicides in controlling the weeds and subsequently increasing the production of onion in the treatments. Same results are in conformity with findings of Vidhyapriyadharshini, H. and Anburani, A., 2004, Yumnam *et.al* 2009. Chopra, N. and Chopra, N. K, 2006. The pre-plant application of Oxyfluorfin 23.5 EC @ 240 g.a. i/ha followed by post-emergence application of

Fenoxaprop – p-ethyl 9 EC @ 270g ai/ha (Two times at 25 and 45 DAT) resulted in effective control of various broad-leaf and grassy-weeds and recorded lower weed density, weed biomass, weed index and higher weed control efficiency.

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